



THE UNIVERSITY *of* EDINBURGH

## Edinburgh Research Explorer

### Understanding the influence of servitization on global value chains

**Citation for published version:**

Gölgeci, I, Gligor, D, Lacka, E & Raja, JZ 2021, 'Understanding the influence of servitization on global value chains: A conceptual framework', *International Journal of Operations & Production Management*.  
<https://doi.org/10.1108/IJOPM-08-2020-0515>

**Digital Object Identifier (DOI):**

[10.1108/IJOPM-08-2020-0515](https://doi.org/10.1108/IJOPM-08-2020-0515)

**Link:**

[Link to publication record in Edinburgh Research Explorer](#)

**Document Version:**

Peer reviewed version

**Published In:**

International Journal of Operations & Production Management

**Publisher Rights Statement:**

© 2021, Emerald Publishing Limited. This AAM is provided for your own personal use only. It may not be used for resale, reprinting, systematic distribution, emailing, or for any other commercial purpose without the permission of the publisher.

**General rights**

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

**Take down policy**

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact [openaccess@ed.ac.uk](mailto:openaccess@ed.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.



# **Understanding the influence of servitization on global value chains: A conceptual framework**

## **Abstract**

**Purpose** – This paper examines the servitization phenomenon in the context of global value chains (GVCs) and presents a conceptual framework by connecting the two literature streams—servitization and GVCs—to depict the interconnected multilevel processes by which the influence of servitization on GVC structure and governance is manifested.

**Design/methodology/approach** – Drawing on cross-disciplinary literature, we develop a multilevel conceptual framework. The theoretically informed framework advances research on servitization and GVCs, and provides a line of inquiry to be explored as avenues for future research opportunities.

**Findings** – We argue that servitization instigates the formation of new ecosystems and collaborative structures within GVCs, reduces the fragmentation of the overall network structure, and increases embeddedness within the sub-clusters of GVCs. These changes are expected to be reflected in the increase in the complexity of firms' GVC governance tasks, a greater reliance on relational governance, and an increase in the dependency on local partners in terms of the governance of GVCs.

**Originality/value** – This conceptual paper establishes the link between servitization and GVCs, anchors the servitization phenomenon in GVCs, explains how servitizing firms can engage in and shape GVCs, and offers insights into the servitization-driven changes in GVCs. The conceptual framework is intended to lay the foundation for future empirical research on the link between servitization and GVCs.

**Keywords** Servitization, Global Value Chains (GVCs), Structure, Governance

**Paper type** Conceptual paper

## 1. Introduction

Over the last few decades, interest in servitization has proliferated within operations and industrial marketing management research fields (Rabetino *et al.*, 2018; Raddats *et al.*, 2019; Zhang & Banerji, 2017) with increasing acknowledgments of its effects beyond firm boundaries (Huikkola *et al.*, 2020; Sklyar *et al.*, 2019). Servitization as a phenomenon typically refers to manufacturing firms' shift in focus from products and production to building new revenue streams through customer-focused combinations (or “bundles”) of goods, services, support, self-service, and knowledge and eventually fully-fledged solutions in industrial markets (Baines *et al.*, 2009; Vandermerwe & Rada, 1988). Although servitization is typically a manufacturer's strategy, it takes place in two main ways. First, firms may draw on their internal product and service capabilities, which not many firms possess in totality (Ayala *et al.*, 2019; Bastl *et al.*, 2012; Vendrell-Herrero *et al.*, 2017). Second, they may reach out to value chain partners, mobilize them, and deliver the servitized offering in a coordinated fashion, which is the increasingly dominant and most frequent approach yet to be fully acknowledged and investigated (Chakkol *et al.*, 2018; Johnson *et al.*, 2021; Raddats *et al.*, 2019). Nonetheless, most value chains exist across national borders and signify interdependency among actors, resources, and activities in creating value. Thus, as the delivery of servitized offerings is a macro (i.e., network)-level issue (Burton *et al.*, 2016; Chakkol *et al.*, 2018; Reim *et al.*, 2019), there is a need to explore the interplay between servitization and the properties of global value chains (GVCs) that encompass interorganizational dyads and ecosystems.

GVCs—holistic systems and governance structures of value creation and provision that span across multiple countries—explain how international investment and trade create cross-border production networks that link multiple actors around the globe (Ponte *et al.*, 2019). The utility of GVCs lies in their ability to analyze the entire *structure* of an industry from the production to the consumption of a specific product and the *governance* of the network of actors and the firm-level constituents (Kano *et al.*, 2020). As such, structure—at the macro-level of analysis—and

governance—at the firm-level of analysis—are two fundamental aspects of GVCs (Buckley & Strange, 2015; Gereffi, 2014; Gereffi *et al.*, 2005; Golini *et al.*, 2016; Kano *et al.*, 2020; McWilliam *et al.*, 2020; Ponte & Sturgeon, 2014). Enabling the coordination of value creation and delivery beyond firm boundaries, GVCs have grown in importance, which is in line with the increased interconnectedness of businesses worldwide (Gereffi & Lee, 2012).

However, GVCs have been examined with a heavy focus on production processes and product flows (Gibson & Warren, 2016; Sinkovics *et al.*, 2018), whereas the role of servitization in GVCs has been largely overlooked. Recent research has begun to acknowledge that the production-driven view of GVCs suffers from inadequate attention to the role of servitization (Kano *et al.*, 2020). The literature on cross-border transactions reveals a growing trend of servitization in GVCs (Heuser & Mattoo, 2017; Miroudot & Cadestin, 2017), labeled as “servicification” in some instances (Gereffi *et al.*, 2019; Lanz & Maurer, 2015). That said, although the servitization literature acknowledges the value-adding role of services, such as repair and maintenance, overhaul, condition monitoring, outcome-based contracts, in transforming from goods production to the provision of solutions (Baines & Lightfoot, 2013; Johnson *et al.*, 2021; Jaakkola & Hakanen, 2013), the transformational shift servitization affords, has not been discussed in the context of GVCs. Accordingly, a better understanding of how servitization influences the structure and governance of GVCs is needed for two major reasons. First, for servitization, a better understanding could anchor the servitization phenomenon in GVCs within which it takes place and could advance knowledge of how servitizing firms engage in and shape GVCs. Second, for GVCs, it can provide fine-grained insights into the servitization-driven changes in GVCs that are noted by but not explored in-depth by the extant GVC research (Gereffi *et al.*, 2019; Lanz & Maurer, 2015).

Drawing on the recent calls for replacing the focal-manufacturer perspective of servitization with a multi-actor perspective (Raddats *et al.*, 2019), we examine the influence of servitization on GVCs (Lenka *et al.*, 2018a; Rabetino *et al.*, 2017) and ask: *What is the role of servitization in the*

*structure and governance of GVCs?* In doing so, we depict the interconnected multilevel processes by which the influence of servitization on GVC structure and governance is manifested. We bridge the structure of GVCs at the macro-level of analysis with that of governance at the firm-level of analysis vis-à-vis servitization. We explicate how servitization changes GVCs in terms of their structure and governance therein. As such, we respond to calls for more multilevel theorization in operations and supply chain management (Carter *et al.*, 2015; Lenka *et al.*, 2018b) and contribute to research by advancing the servitization literature stream by complementing it with GVC literature. In the context of the growing importance of servitization in GVCs, our framework provides much-needed insights into the role of servitization in GVCs. In this conceptual paper, we push the theoretical boundaries by connecting servitization and GVC domains, which advances knowledge in both of these respective domains.

To guide the development of our conceptual framework and to account for the intersection of servitization and GVCs, we reviewed and synthesized the extant literature on servitization and GVCs in order to identify gaps in these two major streams of research. As such, our aim is not to undertake a systematic literature review (see for recent notable reviews: Rabetino *et al.*, 2018; Raddats *et al.*, 2019; Zhang & Banerji, 2017) but rather to develop theoretical propositions that signpost the avenues for future research that will bridge both the servitization and GVC domains of research.

## **2. Theoretical background**

### *2.1. Overview of global value chains*

GVCs are defined as holistic systems and governance structures of value creation and provision that involve a multitude of *actors* spanning across multiple countries as well as *activities* and *resources* that run both upstream and downstream (Gereffi *et al.*, 2005). They are the nexus of interconnected functions and operations through which goods and services are produced, distributed, and consumed globally (Kano *et al.*, 2020). The GVC framework proposes a map of what is produced

and where from an industry perspective (Golini *et al.*, 2016). Focusing on product production, GVCs connect spatially dispersed production activities worldwide.

GVCs represent a coordinated network of firms and other actors through which the geographical and organizational reconfiguration of global value creation occurs (Gibbon *et al.*, 2008). GVC research recognizes international and subnational spatial heterogeneity (Buckley & Strange, 2015; Mudambi, 2008) and addresses the question of who has control over (i.e., governs) the geographically dispersed activities (Buckley & Strange, 2015). As such, GVC research helps provide a better understanding of cross-border linkages and power relationships between different actors in the global production process (Sinkovics *et al.*, 2018). Accordingly, GVC research has gained popularity when analyzing the international expansion and geographical fragmentation of modern GVCs as well as the value creation and capture therein (Gereffi & Lee, 2012; Strange & Humphrey, 2019) in different research fields, including operations and supply chain management (Gereffi & Lee, 2012; Golini *et al.*, 2016).

GVCs are analyzed in terms of (i) the structure that represents the connection between actors and the whole production process; (ii) the geographic scope that signifies the dispersion of different activities across the globe; (iii) the governance that reflects the authority and power relationships within the chain; and (iv) the institutional context that identifies micro/macro conditions and policies of globalization in each stage of the value chain (Gereffi & Fernandez-Stark, 2011).

In this paper, we focus further on GVC structure at the macro level and governance at the firm level of analysis, which sets a foundation for a multilevel framework. GVC structure refers to the nature and architecture of network connections between relevant actors, activities, and resources across national borders (Gereffi & Fernandez-Stark, 2011). GVC structure is comprised of fluid and dynamic macro-level constellations of economic value creation that encompass the full GVC rather than specific inter-firm nodes (McWilliam *et al.*, 2020). Its key constituents are centrality and

density, linkage heterogeneity, and embeddedness (Kano *et al.*, 2020). In this sense, while GVCs are often conceptualized as asymmetrical or high centrality networks with a lead firm at their center (Kano, 2018), these networks can also be heterogeneous in terms of density, embeddedness, and the presence of structural holes (Kano *et al.*, 2020; Simsek *et al.*, 2003). On the other hand, the governance of GVCs involves orchestrating the use of resources through codified and uncoded routines and managerial practices to ensure the smooth functioning of the entire network (Kano, 2018). Key GVC governance tasks and decisions include setting up the GVC network and selecting actors to be included, assigning roles to GVC members, coordinating partners' activities, and distributing value across the GVCs (Kano, 2018). Thus, the governance of GVCs is embodied by the role of lead firms in GVCs as well as their management and orchestration of interorganizational relationships in GVCs (Kano *et al.*, 2020).

GVCs are multilevel economic entities that comprise firms and ecosystems. Although extant research has been slow to recognize the multifaceted and multilevel nature and constituents of GVCs, the multilevel examination of GVCs has been slowly gaining traction (Lipparini *et al.*, 2014; Niforou, 2015; Ponte & Sturgeon, 2014) (see Table 1 for details of multilevel research on GVCs and servitization). For example, Lipparini *et al.* (2014) addressed multi-directional, multilevel, and multiphase knowledge flows in GVCs. Furthermore, Ponte and Sturgeon (2014) offer a modular approach to GVC governance by incorporating firm-(transmission between nodes) and macro-level ("overall" GVC) factors. Although limited, these multilevel studies on GVCs offer valuable early insights into the cross-level interactions within GVCs that we also account for in our multilevel framework.

----- **Insert Table 1 here** -----

## 2.2. *The relationship between GVCs and global supply chains*

Rooted in the operations and supply chain management, the global supply chain management (GSCM) research stream is subtly linked to GVC research (Ferdows *et al.*, 2016; Gereffi & Lee,

2012). GSCM research emphasizes the importance of the complexity and coordination involved in GVCs and the role of specific functional areas of the value chain in firm strategy and governance (Golini *et al.*, 2016). Like GVC research, GSCM research is primarily concerned with the management and coordination of resources, value chain partners, and interorganizational activities to deliver economic value across national borders. As such, GVC research could be utilized in operations and supply chain management to understand the growing complexity of managing global operations (Ferdows, 2018).

That said, notable differences between the GVCs and GSCM exist. First, GVCs differ from global supply chains as the former typically provides a higher level industry view of the input-output processes, while the latter typically denotes how product and information flows are managed at the firm level and with its suppliers and customers (Golini *et al.*, 2016). As such, while GVC research is often industry-focused—with a growing number of exceptions in recent years (cf. Kano, 2018)—GSCM research often is and remains firm-focused (Connelly *et al.*, 2013). Second, while GSCM research is positioned primarily within the management domain, GVC research typically draws more heavily from economic geography and economic sociology. Thus, GVC research focuses on the social, spatial, and developmental implications of GVCs, while GSCM research primarily focuses on the strategy and performance of firms involved in such value creation systems. Third, due to their intellectual roots and primary foci, while GVC research pays greater attention to GVC structure and governance as well as locations of economic activity (Gereffi & Fernandez-Stark, 2011), GSCM research pays greater attention to agency and managerial mechanisms within GVCs. Despite the differences, these two research streams offer complementary insights. For example, while GVC research enables capturing the bigger picture (Gereffi *et al.*, 2005), GSCM research enables a limited yet more detailed analysis of the capabilities and behaviors of specific actors (e.g., firms and individuals) involved in GVCs (Connelly *et al.*, 2013).



### 2.3. Overview of the servitization phenomenon within and across national borders

Thus far, GVCs have been examined with a heavy focus on production processes and product flows (Gibson & Warren, 2016; Sinkovics *et al.*, 2018); however, while product customization, variety, and innovation may enable product differentiation (Sousa & da Silveira, 2020), conventional manufacturing is increasingly becoming a low value-added activity where competitive differentiation is difficult to achieve, especially in low technology-intensive and less innovative industries (Mudambi, 2008). Consequently, many manufacturing firms add value to their offerings by supplementing them with service offerings that the literature refers to as servitization (Baines *et al.*, 2009; Vandermerwe & Rada, 1988).

Representing a major change in the firm's business model and mission, servitization is the evolution of a firm from a product- toward a service-centric approach (Rabetino *et al.*, 2018; Raddats *et al.*, 2019). Servitization is therefore considered a transformative process through which a focal manufacturing firm sets out to increase the share of services in its offerings (Vendrell-Herrero *et al.*, 2017). Increasingly, servitization requires establishing new interorganizational relationships and utilizing service ecosystems outside the firm (Kohtamäki *et al.*, 2019; Sklyar *et al.*, 2019). As such, the transformational shift encompasses not only a focal firm but also other actors in the firm's network, which also undergo a transformation (Tronvoll *et al.*, 2020). This complex nature of servitization that spans beyond a focal firm enhances the network's role in firm strategy and behavior and strengthens the relationships between networked actors (Bastl *et al.*, 2012; Vendrell-Herrero *et al.*, 2017). This is because service ecosystems, as parts of GVCs, underscore the systemic aspects of value cocreation, emphasizing service exchange and resources across interdependent actors (Koskela-Huotari *et al.*, 2016; Vargo & Lusch, 2017), which is in line with research on product-service networks (Jaakkola & Hakanen, 2013; Reim *et al.*, 2019) and the research on the link between servitization and supply chain management (Baines *et al.*, 2009; Chakkol *et al.*, 2018),

both of which offer valuable insights into how service is created and delivered across and beyond organizational boundaries.

Acknowledging the path-dependent and interconnected nature of servitization, a small set of research on servitization has examined it across multiple levels (Lenka *et al.*, 2018a, 2018b) (see Table 1). In particular, Lenka *et al.* (2018a) found that individual mechanisms of evangelizing, bootlegging, leveraging, and collaborating help overcome organizational resistance to firm-level servitization. Likewise, Lenka *et al.* (2018b) noted that servitizing firms' organizational ambivalence is manifested at multiple levels due to co-existing product and service orientations.

The introduction of value-adding services to products leads to changes in the firm and the ecosystem in which the focal firm operates; service ecosystems are considered a crucial constituent of the servitization journey (Palo *et al.*, 2019; Rabetino *et al.*, 2017). In these ecosystems, multi-layered and extensive collaboration activities with a multitude of actors in local and increasingly global contexts create value (Chakkol *et al.*, 2018; Huikkola *et al.*, 2020; Jaakkola & Hakanen, 2013; Reim *et al.*, 2019). Notably, although research attention has been devoted to understanding servitization in networks of actors operating within the borders of a country in which the focal firm operates, the interplay between servitization and GVCs has received relatively less attention.

#### *2.4. The interface of servitization and global value chains*

Services are viewed as the glue that holds value chains together. International manufacturing firms increasingly produce and export services either as compliments or substitutes to the goods they sell in digital or other forms (Miroudot & Cadestin, 2017). Nonetheless, the intangibility of services in GVCs makes them analytically and statistically more elusive than products (Lanz & Maurer, 2015; Miroudot & Cadestin, 2017). International transactions in services are difficult to measure (Heuser & Mattoo, 2017). As such, servitization have received asymmetrically limited attention in GVC research than production and product flows. Within the servitization literature, the focus has largely been on a focal firm's transformational shift and network of actors operating within country

boundaries (Story *et al.*, 2017). That said, limited research examined servitization in the global context (see Table 2 for details).

----- **Insert Table 2 here** -----

The flow of products entails cross-border networks linking firms and countries worldwide (Ponte *et al.*, 2019); however, for firms engaging in servitization, the old frameworks hold less explanatory power as they do not account for the need for service creation and offerings to occur at the point of consumption to accompany the physical goods. This servitization-driven change poses challenges and opportunities for GVCs.

One challenge for GVCs is that some of the value must be created where the customer is located as part of the service; an important foundational premise of the service-dominant logic perspective is that value is always co-created with the customer (Vargo & Lusch, 2017). Hence, this presents a significant opportunity because the quality is judged not only by the end product but also by how the (accompanying) service is produced (Macdonald *et al.*, 2016). Thus, servitization extends GVCs' scope by providing additional means to create value.

Servitization also alters the design of GVCs by requiring them to physically locate some of their service offering components to locations (countries) where their end customers are based. By doing so, GVCs are subject to local governments' and institutions' control and must comply with their regulations and guidelines at the macro-level. This further increases GVCs' complexity. Thus, in the context of servitization, it is difficult to provide comprehensive explanatory frameworks that explore the integration of servitization within GVCs without accounting for such macro-level factors in addition to firm-level factors.

### **3. Conceptual framework**

Servitization involves a close interorganizational interaction, which underscores its close connection to ecosystems research and the overlooked relevance to GVCs (Akaka *et al.*, 2013; Chandler *et al.*, 2019; Lenka *et al.*, 2018a). The strategy, governance, and resources and capabilities behind

servitization typically occur at the firm level (Raddats *et al.*, 2019). The network structure of interorganizational relationships and the influence of the external environment occur at the macro-level (Vendrell-Herrero *et al.*, 2017). As such, although servitization is typically conceptualized and analyzed at the firm level, there is a growing recognition that it is nested within macro-level networks, such as GVCs. Guided by the literature, we employ a multilevel approach to develop our framework.

The multilevel theorization approach was considered appropriate for several reasons. First, firms and GVCs represent multilevel systems, and firms are nested within GVCs (Carter *et al.*, 2015; Kano *et al.*, 2020). The key goal of employing a multilevel perspective is to obtain better-integrated knowledge of phenomena occurring across different levels of the system (Klein & Kozlowski, 2000), which is the core aim of this paper. Second, we adopt the multilevel approach to untangle the linkages between servitization and GVC structure and governance with the recognition that micro (i.e., firm) phenomena are rooted in macro contexts, and macro phenomena typically occur based on the dynamics and interactions between micro-level elements. While theorizing at either level can provide unique insights, neither single-level perspective can adequately provide a holistic view of the system itself (Carter *et al.*, 2015; Klein & Kozlowski, 2000). Multilevel studies help shed light on the context within which actions are embedded and combine various perspectives to offer integrated, richer, and deeper insights (Klein *et al.*, 1999). Because this paper aims to offer a holistic view of the servitization-driven changes in GVC structure and governance, a multilevel study is appropriate.

To develop our framework, we followed the principles of multilevel theory-building proposed by Klein and Kozlowski (2000). We first identified the need for multilevel research on servitization. The majority of extant research on servitization examines it at the firm level (e.g., Baines & Shi, 2015; Huikkola *et al.*, 2020; Kohtamäki *et al.*, 2019; Lenka *et al.*, 2017; Palo *et al.*, 2019; Rabetino *et al.*, 2017); however, as there is increasing recognition of the embeddedness of

servitization in macro-level contexts (Akaka *et al.*, 2013; Sklyar *et al.*, 2019), the servitization phenomenon is deemed suitable for multilevel theorization, especially in relation to GVCs. Following this, we examined servitization at the firm level and explored its potential impact on GVCs through bottom-up (through servitization processes in explaining collective phenomena in GVCs) processes. Finally, we engaged in multiple iterations of the framework generation process to gauge the scope of our theorization and to explain the interactions within and across the levels. In doing so, we cross-fertilized insights from research, concentrating on each level of analysis to account for potential interactions across two levels. In the next section, we state a set of propositions for further research to shed light on how servitization changes the structure and the governance of GVCs. For a further discussion on multilevel theory building, we refer the reader to Klein and Kozlowski (2000).

### *3.1. The role of servitization in the structure of GVCs*

The discussion of our conceptual framework begins by examining the potential role of servitization in the structure of GVCs (Gereffi & Fernandez-Stark, 2011; Gibson & Warren, 2016; Golini *et al.*, 2016; Lanz & Maurer, 2015; Sinkovics *et al.*, 2018). An important decision regarding GVC structure is how leading firms configure their value-creating activities across network nodes and locations (Gibson & Warren, 2016; Ponte & Sturgeon, 2014). Servitization represents a transformational force in how GVC structures are configured (Palo *et al.*, 2019; Raddats *et al.*, 2019). With servitization comes new activity and structural configuration possibilities for GVCs (Gibson & Warren, 2016) and changes in GVC boundaries and connections (Huikkola *et al.*, 2020). This is particularly true in relation to digital servitization, where digitalization transcends location limitations and instigates collaboration with actors from outside traditional boundaries (Sklyar *et al.*, 2019). While implementing servitization, GVCs may be compelled to reconfigure value-creation activities and interorganizational connections. The formation of new service-driven partnerships in servitizing GVCs often occurs in emerging domains of service ecosystems.

Given their sophisticated and path-dependent nature, services increasingly rely on ecosystems (Akaka *et al.*, 2013; Koskela-Huotari *et al.*, 2016). Service ecosystems are defined as “relatively self-contained, self-adjusting systems of resource-integrating actors connected by shared institutional logics and mutual value creation through service exchange” (Vargo & Akaka, 2012, p. 207). They encompass the broad socio-economic and physical contexts in which firms operate based on institutionalized rules and expectations (e.g., Chandler *et al.*, 2019). Service ecosystems are important macro-level constituents of GVCs and embody complementarities between different aspects of services bundled in specific products/service offerings (Phillips & Ritala, 2019). In contrast, GVCs denote all the relationships between and governance of interdependent actors involved in overall value creation (Kano *et al.*, 2020). For example, Samsung Electronics’ GVC encompasses all actors, activities, and resources involved in the production (including raw materials and components), logistics, and service operations to create its value offerings; however, service ecosystems in Samsung’s GVC primarily denote the coordinated complementarity between service providers (e.g., App developers), even if some service providers do not directly collaborate. Likewise, while GVCs span multiple countries and often encompass the whole world (Gereffi *et al.*, 2005), the geographic scope of service ecosystems is more limited to a certain region, such as Silicon Valley, or an industrial cluster, such as harbors and airports (Kohtamäki *et al.*, 2019). Consequently, GVCs encompass several ecosystems, including production and service ecosystems. Service ecosystems allow for allocating service tasks, interorganizational brokering, organizational learning, and resource combination for effective service innovation, creation, and provision (Koskela-Huotari *et al.*, 2016; Aarikka-Stenroos & Ritala, 2017). They are considered a vital aspect of the servitization journey and successful service delivery (Palo *et al.*, 2019; Rabetino *et al.*, 2017). As such, service ecosystems could inform how GVC structures transform along with GVC members’ servitization journeys.

As noted, servitization has prompted the development of new ecosystems and collaborative structures with GVCs (Huikkola *et al.*, 2020). GVCs are fluid and dynamic value creation structures that adapt to changing circumstances (Gereffi, 2014) and that may respond to servitization with the formation of new service ecosystems. Their network structure can be reshaped along with the contemporary transformation of their members' business models, such as servitization (Gereffi, 2014; Gereffi & Fernandez-Stark, 2011). Hence, servitization can manifest its structural impact on GVCs by prompting the formation of new ecosystems and collaborative structures as part of the servitization transformation that each member and overall GVCs involve. Thus, we propose:

**P1** *Servitization stimulates the formation of new service-centric ecosystems and collaborative structures within GVCs.*

The core premise of conventional GVCs is their enabling role in the fragmentation and dispersion of production/value-creating activities across the globe (Kano *et al.*, 2020). Such fragmentation and dispersion, so-called “slicing-up” (Timmer *et al.*, 2014), are enabled by logistics and information technologies, containerization, activity and labor specialization, cost differentials across locations, and product modularity. As such, the fragmentation of activities and actors along GVC structures is one of the hallmarks of contemporary GVCs.

Nonetheless, the increasing prevalence of services in the overall value proposition requires being more proximate to customers to enable closer interactions (Smith *et al.*, 2014). It may curb “slicing up” activities at GVCs (Timmer *et al.*, 2014). By its nature, the servitization process entails less codifiable and path-dependent activities (Chakkol *et al.*, 2018; Vendrell-Herrero *et al.*, 2017) that require the consolidation and concentration of value creation activities and closer connections between GVC members (Gereffi *et al.*, 2019). The increasingly visible growth in information and service exchange across the globe (Gereffi, 2014; Wolf, 2020) points to the notion that servitization challenges the fragmentation of production activities. Behavioral attributes of services curb the

possibility of slicing up such activities across national borders and assembling them at another location. Thus, GVCs incorporating servitization may experience a reduction in activity fragmentation across national borders and may witness a greater concentration of local and embedded ties. New service-driven close partnerships might be formed to enhance value-added components in offerings.

Furthermore, despite a profound history of trade and economic liberalization, services in many countries continue to be safeguarded by limits on foreign services and service providers (Heuser & Mattoo, 2017). Global cooperation in services has proved to be resistant against fragmentation due to the impracticality of decoupling service production and consumption in most cases as well as restrictions on global labor mobility (Heuser & Mattoo, 2017). Challenges related to labor mobility limitations, anti-globalization, and localization demands have been increasingly prevalent forces that impede the further modularization and fragmentation of service-driven GVCs (Wolf, 2020). Therefore, we propose:

**P2** *Servitization reduces the fragmentation of GVCs' overall network structures.*

A servitization-driven reduction in the fragmentation of GVCs' overall network structures could be followed by increased embeddedness within the sub-clusters of GVCs. Embeddedness in a network structure increases when the number of external ties decreases in proportion to the number of internal ties and when the quality of dyadic exchanges increases as manifested by greater trust, commitment, and engagement between network members (Simsek *et al.*, 2003). As such, embeddedness is an important factor in explaining GVC structure, especially when GVCs undergo servitization (Soontornthum *et al.*, 2020).

Service-related knowledge is more tacit than production-related knowledge (Mudambi, 2008). Likewise, intermediate and advanced services adapted during the servitization journey compel GVC members to establish and to maintain more embedded and long-term relationships



and help servitizing firms strengthen their relationships with their customers and capture revenue throughout the lifetime of products they offer (Hakanen *et al.*, 2017). Thus, the codifiability of service-related information is more difficult (Strange & Humphrey, 2019); however, the extent to which information can be codified to facilitate interorganizational transactions is considered an essential bedrock of the expansion and fragmentation of GVCs (Gereffi *et al.*, 2005). This will likely prove challenging when services, which are more tacit and less codifiable, are involved. Although digital servitization may address this issue to some degree, an overreliance on technological tools can hinder service growth (Tronvoll *et al.*, 2020).

We argue that servitization enhances embeddedness between GVC members, particularly within their sub-clusters. The very nature of most services that require simultaneous production and consumption entails closer interactions between the value exchanging actors of GVCs (Lenka *et al.*, 2017). Likewise, with a greater infusion of services in product-service bundles comes the greater necessity of long-term contracts, services tailored to customers' own business processes, and value delivery as a partnership (Sjödin *et al.*, 2019), which can all contribute to greater embeddedness within the sub-clusters of GVCs. In fact, services are known to induce long-term relationships with customers and GVC partners (Miroudot & Cadestin, 2017). Accordingly, servitization necessitates closer interactions between GVC partners that can engender a greater degree of embeddedness within the service-driven sub-clusters of GVCs. GVCs that incorporate servitization may experience a greater degree of localization due to intensified customer interactions and the concurrent production and consumption of value. This localization and clustering enable a high degree of embeddedness in local service-driven GVCs. Accordingly, we propose:

**P3** *Servitization increases embeddedness within the sub-clusters of GVCs.*

### 3.2. *The role of servitization in the governance of GVCs*

Firms undergoing servitization must closely manage their local service partners, such as distributors, component suppliers, and service suppliers, to ensure they meet customers' expectations (Bastl *et al.*, 2012). Due to the intangible nature of services, it may be more difficult to objectively assess the quality of services than to assess the quality of goods (Macdonald *et al.*, 2016). Moreover, as a result of the changes in the service ecosystem, for example, in the drive towards digital servitization, partners must adapt to each other (Phillips & Ritala, 2019; Sklyar *et al.*, 2019). With that in mind, we now focus on firm-level influences of servitization on GVCs.

Understanding governance approaches and their implications is an essential aspect of managing GVCs (Özatağan, 2011). Governance tasks are an important undertaking for servitizing firms to effectively manage and leverage their GVCs. The complexity of the transactions in GVCs and the supply-base capabilities directly impact how GVCs are governed (Gereffi *et al.*, 2005). Servitization leads to increased complexity in transactions occurring in the GVCs and a shift in the supply base, therefore changing the management approaches required for effective governance. Indeed, research shows that as GVCs become complex, existing governance frameworks may be inadequate to deal with the challenges (Ferdows, 2018; Kano, 2018; Strange & Humphrey, 2019). This is because more complex solutions—as well as multinational service agreements—require central coordination and governance (Beirão *et al.*, 2017; Sjödin *et al.*, 2019), which Sklyar *et al.* (2019) have shown to also be the case in relation to firms undergoing digital servitization.

Before servitization, firms could focus primarily on the quality of the goods produced by their GVC partners and were not concerned about the quality of services as they were not bundled with goods. During servitization, firms ought to monitor and assess the quality of their local service suppliers' services and relationships with their local customers. Additionally, as discussed, servitization is likely to require GVCs to share more sensitive information with their local suppliers; this, however, may lead to “knowledge leakages” (Ayala *et al.*, 2019, p.2). The potential for

knowledge leakages is exacerbated by the possibility of local suppliers working with multiple GVCs. By sharing a common pool of local suppliers, GVCs are more exposed to unethical supplier practices. With more services on offer, the breadth and depth of interactions between parties increase (Lenka *et al.*, 2017). Managing these additional interactions further complicates the governance of GVCs. Combined, these aspects of servitization make it more difficult for firms to manage their GVCs. Hence, we posit:

**P4** *Servitization increases the complexity of firms' GVC governance tasks.*

Determining the governance type is a central issue within GVCs as “a chain without governance would just be a string of market relations” (Humphrey & Schmitz, 2001, p. 20). As such, ample efforts have been devoted to understand how firms can best structure the governance of their GVCs (Gibbon *et al.*, 2008; Kano *et al.*, 2020; Ponte & Sturgeon, 2014). Extant research suggests five basic GVC governance types: markets, modular GVCs, relational GVCs, captive GVCs, and hierarchy (Gereffi *et al.*, 2005). The first type of GVC governance, markets, captures market transactions that include repeat transactions. The second type, the modular chains, is specific to GVCs, where suppliers make products according to the customers' specifications, which may require capabilities to deliver the required products but typically involve generic resources, reducing transaction-specific investments. The third type, relational governance, describes networks characterized by complex buyer-supplier interactions, leading to significant levels of asset specificity and mutual dependence. The fourth type, captive GVCs, captures networks where small suppliers are transactionally reliant on larger buyers. Because they face high switching costs, suppliers are captive. Large firms engage in a high degree of control and monitoring within such chains. Finally, hierarchy describes a form of governance characterized by vertical integration and significant control flowing from the headquarters to the affiliates and subsidiaries.

Four significant servitization-driven changes are likely to impact GVC governance and its types. First, servitization is altering the makeup of GVCs by increasing the number of service-focused partners as opposed to production-focused partners (Chakkol *et al.*, 2018). Considering that service providers typically employ fewer assets than goods producers to meet their customers' requirements (Raddats *et al.*, 2019; Vendrell-Herrero *et al.*, 2017), this shift reduces suppliers' dependence on buyers due to a reduction in asset specificity. That is, service providers are better positioned than goods producers to avoid making transaction-specific investments as such investments create buyer dependence and give buyers increased power within the relationship. Second, given the unique aspects of services (e.g., customization, required training, standardization difficulty), it is less feasible for buyers to engage in transactional exchanges with service-providing suppliers than it is with goods-producing suppliers. Contractual governance mechanisms are often unable to address uncertainties surrounding servitization (Johnson *et al.*, 2021). Third, as indicated, servitization increases the complexity of firms' GVC governance tasks, further altering the distribution of power between partners within GVCs. Fourth, as services are added to products during the servitization process, the complexity of transactions increases, while the codifiability of transactions decreases (Gereffi *et al.*, 2019; Ponte & Sturgeon, 2014). Likewise, servitizing firms would be more likely to choose suppliers with higher levels of capabilities that would instigate a greater reliance on relational governances (Ponte & Sturgeon, 2014). Combined, these four trends are likely to level the playing field for GVC partners (from a dependence and power perspective), and thus lead GVCs to increasingly rely on relational governance. Formally stated:

**P5** *Servitization leads firms in GVCs to rely more on relational governance.*

Considering that services need to be offered at the point of consumption, firms may need to enlist the support of local partners, including service suppliers and component suppliers (Raja & Frandsen, 2017) to co-create value with local customers (Lenka *et al.*, 2017). Suppliers provide

services to the focal servitizing firm to assist it in providing services to its customers. For example, firms undergoing digital servitization are known to use technology to support digital services provided by local partners (Sklyar *et al.*, 2019). In essence, servitization leads local partners to act as extensions of the global firms and their GVCs and increase their dependency on local partners.

Understanding dependency in GVCs is an essential requirement for explaining the development of successful, long-lasting partnerships (Schmitz *et al.*, 2016). Interestingly, buyer-supplier relationship studies highlight that elements such as trust and commitment are required to achieve positive relational outcomes (Mpinganjira *et al.*, 2017); however, these elements can result in negative relational outcomes when they lead one party to be too dependent on the other (Schmitz *et al.*, 2016). This highlights the importance of recognizing the increased dependency on partners that occurs in GVCs due to servitization.

Moreover, servitization requires firms to share specialized knowledge with local GVC partners (Ayala *et al.*, 2019). It is also possible for many local partners to lack the required resources and capabilities to offer innovative services to local customers. Therefore, GVCs might need to invest in their local partners to develop the necessary competencies and service offerings (Rabetino & Kohtamäki, 2018). Without such investments from large GVCs, many local partners would not be able to transition to servitization (Humphrey & Schmitz, 2002); however, such investments, whether intellectual, financial, or both, further increase GVCs' reliance on local partners (Schmitz *et al.*, 2016).

The move toward services across GVCs aims to both add more customer value and to create long-term relationships with customers (Miroudot & Cadestin, 2017). As such, firms must rely more on local GVC partners to offer quality services that meet customers' expectations and must form and maintain relationships with local customers. Moreover, firms must trust that such local partners invest in digital solutions to enhance customer relationships via digitalization (Sklyar

*et al.*, 2019), which increases the dependency on local partners for servitizing firms. Thus, we propose:

**P6** *Servitization increases firms' dependency on local partners in their GVCs.*

### *3.3. Interlinkages between servitization-driven structural and governance-related changes in GVCs*

Recognizing the possibility of cross-level interactions within GVCs, we now discuss how the macro-level factors interact with firm-level factors. Specifically, at the macro-level, ecosystems have been viewed as a new layer of research that encompasses two specific constituents: co-evolutionary logic and boundaries and composition (Aarikka-Stenroos & Ritala, 2017). The former requires a broader understanding and a prospective view of “what it means to manage and be managed” at a systems level, which is a step beyond the network level. The latter is described as “even more elusive and open-ended, further increasing interdependency, dynamism, and instability” (Aarikka-Stenroos & Ritala, 2017, p. 31). As stated, this has relevance for GVCs, which are an amalgamation of several ecosystems. This raises important issues regarding the complexity and interdependencies between ecosystems, how they are managed, and their ever-expanding boundaries and composition in the case of servitization. The ever-increasing number of actors involved to co-create value increases complexity (Burton *et al.*, 2016; Story *et al.*, 2017), which is also evident in the research on digital servitization ecosystems (Kohtamäki *et al.*, 2019; Sklyar *et al.*, 2019). The multitude of actors engaged in service-centric ecosystems adds to the governance tasks (Johnson *et al.*, 2021), with servitizing firms needing to ensure that the partners within the ecosystem deliver to set standards. An example of a servitizing organization that has led to the formation of new ecosystems and collaborative partnerships within its GVCs is Mitsubishi Logisnext Europe. It is a well-known provider of logistics and materials, handling solutions marketed under various banners (e.g., Mitsubishi Forklift Trucks, Cat® Lift Trucks, Rocla, TCM, and UniCarriers) through its extensive network of independent dealers across several industries.

Over time, it has expanded to provide solutions to customers that include products (e.g., forklifts, warehouse trucks, automated guided vehicles), service and finance packages, and digitalization for each of the different brands it provides using separate networks to address customer needs. This can lead to the formation of new ecosystems and collaborative partnerships within its GVCs as well as to increased complexity (cf. (Aarikka-Stenroos & Ritala, 2017).

For servitizing firms, this adds governance tasks for the increasingly evolving service ecosystems to manage partners to co-create value. Although some point to the use of remote monitoring technology to manage the added complexity for industrial companies (Grubic, 2014), others have discussed the varying levels of complexity based on the provision of smoothing and adapting services or substituting services (Frank *et al.*, 2019), the latter requiring modification in the interaction amongst actors involved. In some cases, servitizing firms may be required to provide accreditation for service partners, which is an additional governance task that also adds complexity. The need for coordination and control becomes an essential aspect of managing ecosystems (Johnson *et al.*, 2021). Therefore, we posit the following:

**P7:** *The servitization-driven formation of new ecosystems and collaborative structures in GVCs is positively associated with the complexity of firms' GVC governance tasks.*

Within GVCs, there is a recognition of the increasing fragmentation of production that creates complexity (Ferdows, 2018), with some suggesting to “reduce the complexity of the network by layering it into simpler and more manageable subnetworks” (Ferdows *et al.*, 2016, p. 63). Although GVC research acknowledges the role of associated services for products, the changing composition of the networks and ecosystems with more service-focused partners has not been adequately addressed to date. Moreover, the difficulties in attempting to fragment services in the same way as production activities have not been discussed.

Within servitization, the increasing “need for being ‘close to the customer’ and being able to sell and customize complex knowledge-intensive solutions to customer-specific needs” are considered necessary to balance the global and local activities for diverse local markets (Hakanen *et al.*, 2017, p. 175-76). As such, servitization arguably acts against the fragmenting or “slicing-up” of activities. In part, the need for relational governance may also be driven by laws and regulations that do not allow for the fragmenting of service-related activities as they do production-related activities. Instead, there is a need to consider the embedded nature of inter-firm relationships within networks (Lipparini *et al.*, 2014) in two respects. First, structural embeddedness—the network’s overall architecture in understanding the boundaries of the network and the internal and external ties—is necessary (Simsek *et al.*, 2003). Structural embeddedness influences the sharing of skills, knowledge, and resources (Hakanen *et al.*, 2017) amongst actors within a service ecosystem (Sklyar *et al.*, 2019). Second, relational embeddedness, meaning the quality of dyadic exchanges (Simsek *et al.*, 2003), serves as a lubricant for relational governance in closely knitted GVC networks. As such, servitizing firms within GVCs are likely to embed themselves more locally, opting for a relational governance approach that permits closer interactions and mutual dependence (Gereffi *et al.*, 2005). Hence, we propose:

**P8:** *The servitization-driven reduction in the fragmentation of GVCs’ network structures is positively associated with an increase in relational governance.*

A greater structural embeddedness within a network is likely to occur within the sub-cluster of GVCs due to servitization. Servitization is predicated on a longer-term, relational approach (Bastl *et al.*, 2012; Sjödin *et al.*, 2019), with product support needed over the lifecycle of the offering (Rabetino *et al.*, 2015). To provide such support, servitizing firms are confronted with the choice of whether to develop capabilities internally to service customers, to embark on an externalization, or to adopt a hybrid approach (Kowalkowski *et al.*, 2011). Even though extant literature focuses on the



internal approach and neglects the role of service partners in selling and delivering services, it is not uncommon for firms to access the capabilities of other firms to achieve their goals (Beirão *et al.*, 2017; Vendrell-Herrero *et al.*, 2017), with some “often subject to dependence on external actor capabilities to succeed in the market” (Burton *et al.*, 2016, p. 43). The success of servitizing firms can be dependent on service network partners (Vendrell-Herrero *et al.*, 2017). Hullova *et al.* (2019), for example, examined independent distributors within a servitization context, reporting that they play an intermediary role between manufacturers and customers that provides profound insights into customer needs that guide manufacturers’ servitization initiatives. This is largely attributed to their proximity to the customer in delivering services, such as providing training, repairs, and spare parts over the lifecycle of the equipment.

Manufacturers embarking on servitization may also expand by developing an external service partner network in GVCs (Kowalkowski *et al.*, 2011; Raja & Frandsen, 2017). As such, for many manufacturers, growing imperatives necessitate moving beyond firm boundaries, requiring cooperation and a holistic management of inter-firm dependencies (Kowalkowski *et al.*, 2016). To an extent, the reliance on external local partners in GVCs reduces the need for managing the linkages within the same firm, causing a shift from a hierarchy governance type to a more relational linkage type (Gereffi *et al.*, 2005). Consequently, this introduces complexities in terms of ensuring consistency in service delivery and managing supplier relationships (Sjödin *et al.*, 2019). Research evidence indicates that there is a constant need for alignment and coordination amongst service partner networks when expanding to new markets (Raja & Frandsen, 2017). For example, the Danish pump manufacturer Grundfos maintains a distributed service partner network that supports product offerings from repair and maintenance to complete water solutions for customers. In far-flung markets, this requires Grundfos to be largely dependent on local partner organizations that are embedded locally within GVC service sub-clusters to address customer needs. This leads us to posit the following:

**P9:** *Firms' dependency on local partners is positively associated with the increase in the servitization-driven embeddedness within the sub-clusters of GVCs.*

Our conceptual framework is depicted in Figure 1.

----- **Insert Figure 1 here** -----

#### **4. Discussion and conclusions**

Although it is not solely a firm-centric phenomenon, thus far, servitization has been largely studied from the firm-level perspective (e.g., Baines & Shi, 2015; Neely, 2008; Palo *et al.*, 2019; Rabetino *et al.*, 2017). Recognizing the need to account for the network of interconnected and interdependent actors across national borders offered by the GVC perspective, in this paper, we develop a multilevel framework that considers the broader macro-level *and* firm-level considerations in advancing research on servitization and GVCs. Importantly, we argue that the different levels function independently as well as interactively, make a case for exploring how servitization influences the structure and governance of GVCs, and state a set of propositions (see Figure 1). Our framework offers several theoretical and managerial implications and opens avenues for future research.

##### *4.1. Theoretical implications*

We make several theoretical contributions to research examining servitization (Johnson *et al.*, 2021; Kohtamäki *et al.*, 2020; Neely, 2008; Sousa & da Silveira, 2020) and particularly to the emerging literature at the interface of servitization and GVCs (Miroudot & Cadestin, 2017; Reim *et al.*, 2019). Extant research has typically focused on the servitization strategies (e.g., Rabetino *et al.*, 2017; Sklyar *et al.*, 2019), processes (e.g., Baines & Shi, 2015; Palo *et al.*, 2019; Zhang & Banerji, 2017), inter-firm relations (e.g., Bastl *et al.*, 2012), and ecosystems (e.g., Sklyar *et al.*, 2019). These contributions have been vital in developing the servitization research domain. Nonetheless, there is a need for uncovering how servitization affects the structure of GVC activities and firms' governance behaviors in GVCs.

At the macro level, we advance the argument that servitization is likely to reshape GVCs in terms of their network structure of value-creating activities. Recognizing the rise of ecosystems as a component of GVCs (Akaka *et al.*, 2013; Beirão *et al.*, 2017; Koskela-Huotari *et al.*, 2016) and as a means of resource-integration through shared institutional logics and collaborative service exchange (Vargo & Akaka, 2012), we argue that servitization facilitates the emergence of new service-ecosystems in GVCs. We consider servitization a driving force behind the change in GVC structures and the evolution of service ecosystems in GVCs. Hence, we advance that servitization stimulates the formation of new service-centric ecosystems and collaborative structures within GVCs. Likewise, acknowledging the cohesive nature of service production and consumption, an amplified demand for a close partnership between product and service providers, and the tacit nature of much service knowledge, we advance that servitization can reduce network fragmentation and increase embeddedness within the service-based sub-clusters of GVCs. This means that servitization can reshape the structure of GVCs, rendering some ties obsolete and stimulating the creation of new service-driven ties within GVCs. Advancing the production-driven research on GVCs (Gereffi *et al.*, 2005; Gereffi & Lee, 2012; Gibbon *et al.*, 2008; Kano *et al.*, 2020), we explain how GVC structures are evolving in the face of the servitization transformation. Thus, we offer a better understanding of the contemporary dynamics of and changes in GVCs and surmise that servitization goes hand-in-hand with the current changes in GVCs and interorganizational relationships.

At the firm level, we advance the understanding of the role of servitization in GVC governance. First, we shed light on how servitization increases the complexity of firms' GVC governance, making it more challenging. Servitization entails working closely with local service partners to ensure the effective delivery of services. It increases the complexity of governance tasks due to the breadth and depth of interactions that take place with the provision of more services. Although digital servitization has been argued to improve coordination and collaboration amongst

actors, it also increases the complexity with the different parties involved (Sklyar *et al.*, 2019). Second, adding depth to the understanding of servitization in the governance of GVCs, we detail how a change occurs in the governance types (Gereffi *et al.*, 2005). Given the complex nature of buyer-supplier interactions for servitization that occur over an extended period, we suggest that there is a greater level of mutual dependence and a need for a relational governance approach. Third, we argue that servitization increases firms' dependency on local suppliers in their GVCs. Increased dependency poses certain pitfalls for GVCs, such as increased power abuses by less dependent actors (Gereffi *et al.*, 2005; Özatağan, 2011). This makes it more critical for firms in GVCs to cultivate supplier trust and commitment to mitigate the threats posed by increased dependency (Mpinganjira *et al.*, 2017).

We also make an important contribution by discussing the interlinkages between macro-level and firm-level, and thus, we contribute to the literature as follows. First, we note that the formation of new servitization-driven ecosystems leads to new boundaries and collaborative structures in GVCs, which in turn will likely result in the increased complexity of the firms' governance tasks. Second, the same extent of fragmentation of service-related activities in GVCs is not likely to be possible, as is typically the case with production GVCs because services require a greater level of local embeddedness to build trust but also because there are regulatory requirements in different jurisdictions. Moreover, there are also the twin demands of being global and local that need to be squared to be close to the customer (Hakanen *et al.*, 2017). As such, we highlight the importance of firms' structural and relational embeddedness. Lastly, we posit that servitizing firms' dependency on partner organizations will likely increase to realize the effective delivery of services to customers, adding to the need for local embeddedness in GVCs. Such interdependencies require moving beyond the boundaries of servitizing firms and need to be managed (Kowalkowski *et al.*, 2016) with the ongoing need for the coordination and alignment of activities (Raja & Frandsen, 2017).

#### *4.2. Managerial and policy implications*

There are important managerial and policy implications to consider. Our propositions highlight the need for a new understanding of network structures and interorganizational relationships in GVCs as stimulated by the growing presence of servitization. As the knowledge and service-driven elements of economic value creation grow in prominence across many industries and countries (Mudambi, 2008), our framework compels practitioners to rethink GVC structures. In line with our discussion, we suggest that practitioners contemplate how servitization changes network structures and the embeddedness of interorganizational ties and embrace greater inclusion of service providers in their networks.

Managers should also be cognizant of some potential pitfalls of GVCs and servitization. Servitization is likely to increase firms' dependency on local partners in their GVCs. As such, we recommend that managers do not solely rely on contractual forms of governance but develop relational mechanisms (e.g., trust) to ensure their partners do not act opportunistically due to the increased dependency caused by servitization. Addressing these issues in the early stages of the servitization process can help protect firms from the detrimental actions of partner organizations. Moreover, servitization can increase the complexity of firms' GVC governance. Managers are advised to mitigate this risk by simplifying their GVCs to counterbalance the impact of servitization. Some possible measures include eliminating redundant partners throughout the GVC where possible and limiting the number of local partners enlisted to support the GVC's local operations.

An important policy implication of the higher prevalence of servitization in GVCs is the need for reimagining policies aiming at regulating GVCs. In particular, consolidation and concentration of GVCs (Gereffi, 2014) afforded by servitization entail revisiting policies developed with fragment and production-driven GVCs in mind. For example, there might be further room for policymakers to support service- and innovation-driven industries in their countries to make them

an integral part of their economies and account for servitization-driven forces in the formulation of GVC design imperatives. It is becoming increasingly clear that economic advancement and servitization go hand-in-hand (Gereffi *et al.*, 2019; Mudambi, 2008), and we suggest that the policymakers acknowledge and leverage the transformative role of servitization in GVCs.

#### *4.3. Future research avenues*

We conclude the paper by offering directions for future research that, informed by our framework, will further advance the literature and practice in examining the role of servitization in GVCs. While we encourage future research to explore propositions listed in the paper empirically, we also list specific areas which are important to pursue.

At the macro-level, our framework emphasizes the need for a deeper examination of the servitization phenomenon in relation to the structure of GVCs. This research highlights that servitization has macro-level implications related to the structure of GVCs. We encourage empirical researchers to probe further into the interplay between servitization and GVCs. For example, although our proposed framework does not cover the geographic scope of GVCs in-depth for parsimony reasons (Gereffi & Fernandez-Stark, 2011), the location choices for fragmented value creation activities are a fundamental aspect of GVCs (Buckley & Strange, 2015; Gibson & Warren, 2016; Sinkovics *et al.*, 2018). The growing prevalence of servitization may point to the increasing importance of services in location decisions and geographies of GVCs. Future researchers may examine the role of servitization in shifting the geography of GVCs. It is possible that servitizing GVCs would increasingly rely on service providers (Chakkol *et al.*, 2018; Vendrell-Herrero *et al.*, 2017) than GVCs that continue production-driven activity structures. Thus, as servitization can shift the GVC landscape from countries concentrating primarily on production to countries that focus mainly on services and the information economy, future research should explore the role of servitization in the geographical structure of GVCs beyond the structural elements explored in our framework.

Another area future research could explore pertains to how firms' experiences and strategies regarding servitization can be better linked to their interorganizational relationships and governance in GVCs. Researchers may also delve deeper into the multifaceted nature of servitization (Kohtamäki *et al.*, 2020) in relation to firms' activities and interactions with other partners in GVCs. Likewise, local customization and the global standardization of services within GVCs require an in-depth examination at a time when advanced services are gaining prominence (Sjödin *et al.*, 2016). As servitization enables local customization along with the global standardization of services (Cenamor *et al.*, 2017; Sjödin *et al.*, 2016), servitizing firms might be better positioned to customize their value offerings and thus to create a perception of localized value chains. Accordingly, future research should explore the extent to which customers perceive the products created by GVCs as local when accompanied by a service provided locally.

Similarly, as upgrading has emerged as an important topic in the GVC literature (Humphrey & Schmitz, 2002; Mudambi, 2008), servitization can facilitate various types of upgrading for firms in GVCs, such as product upgrading and functional upgrading, as suppliers might be compelled to change their business models to support advanced services. Miroudot and Cadestin (2017) show that adding services as complements or substitutes to goods is closely related to upgrading a firm's overall value offerings. Servitization may enable firms' product upgrading—moving toward more sophisticated product lines—and functional upgrading—acquiring new functions (or the abandonment of existing outdated functions) to increase value creation—in GVCs (Gereffi *et al.*, 2019). Accordingly, future research can delve deeper into the influence of servitization on firms' upgrading outcomes in relation to GVCs.

On a contemporary note, recognizing the benefits servitization affords, many firms have recently opted to add services to their value proposition to mitigate the negative impact of COVID-19 (Rapaccini *et al.*, 2020). The pandemic has escalated the importance of servitization in GVCs as well. Although servitization, digitalization, and digital servitization are expected to accelerate in the

aftermath of COVID-19 (Rapaccini *et al.*, 2020), the role of such a transformational shift in the interconnected network of actors that spreads across national borders has received scant research attention from a GVC perspective.

The above areas of future research highlight the need for diverse methodological approaches when investigating the impact of servitization on GVCs. To gain a comprehensive perspective on the phenomenon of interest, data should be collected and analyzed at two distinct levels: the firm- and macro-levels. These approaches would facilitate the development of rich theoretical insights at multiple levels and would enable wide-ranging theory development in this area of growing interest. Likewise, future research can explore the proposition this research posits utilizing various data sources, ranging from primary qualitative and quantitative datasets to big datasets generated from technological change and GVC transition. In this big data era, the importance of insights generated from such datasets is undeniable, and data triangulation is often an effective means of addressing limitations involved in any research design (McGrath, 1981).



## References

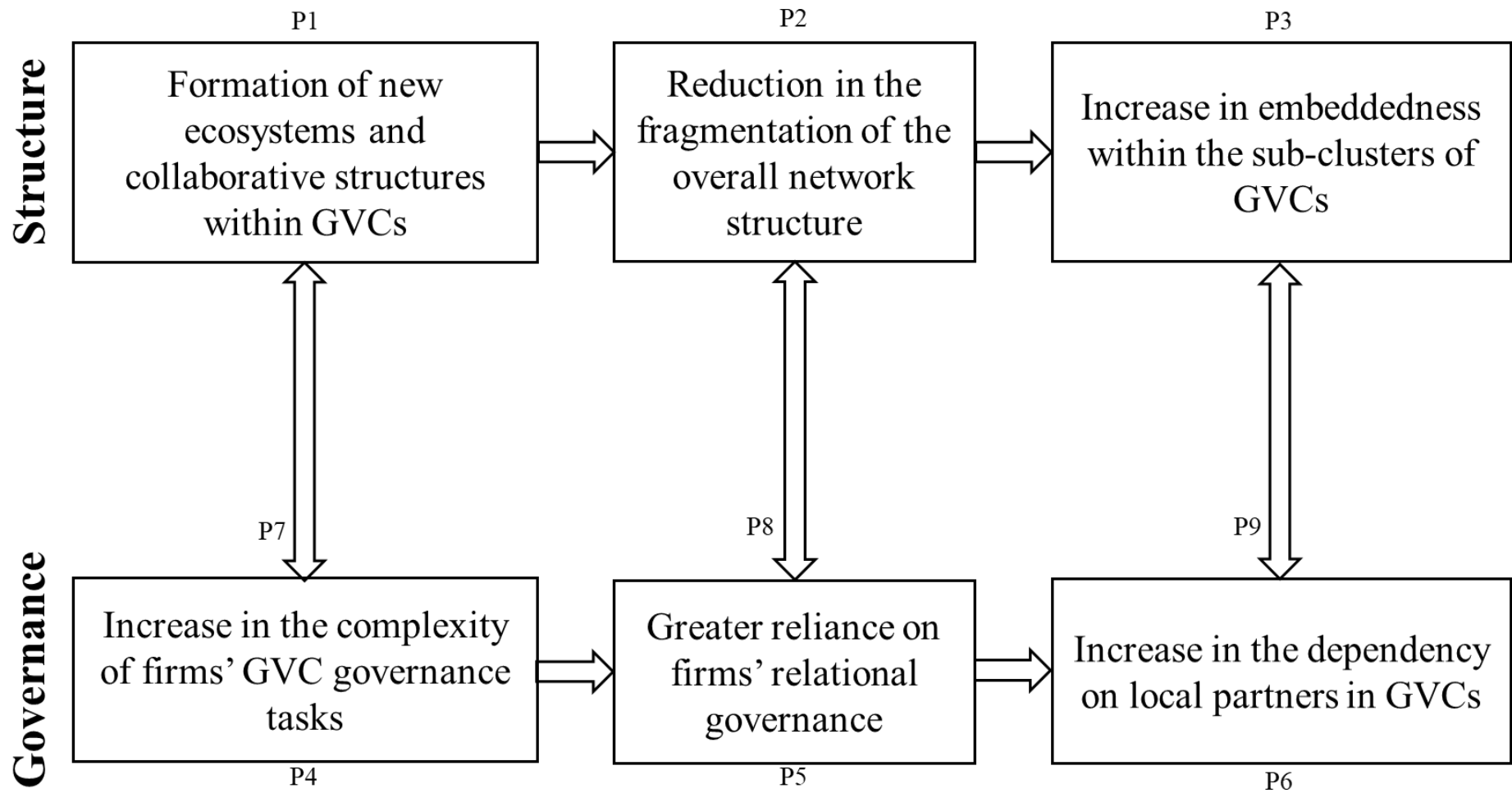
- Aarikka-Stenroos, L. and Ritala, P. (2017), "Network management in the era of ecosystems: Systematic review and management framework", *Industrial Marketing Management*, Vol. 67, pp. 23-36.
- Akaka, M. A., Vargo, S. L. and Lusch, R. F. (2013), "The complexity of context: A service ecosystems approach for international marketing", *Journal of International Marketing*, Vol. 21 No. 4, pp. 1-20.
- Ayala, N. F., Gerstlberger, W. and Frank, A. G. (2019), "Managing servitization in product companies: the moderating role of service suppliers", *International Journal of Operations & Production Management*, Vol. 39 No. 1, pp. 43-74.
- Baines, T. and Lightfoot, H. (2013), *Made to serve: What it takes for a Manufacturer to Compete*, Wiley, Hoboken, NJ.
- Baines, T., Lightfoot, H., Peppard, J., Johnson, M., Tiwari, A., Shehab, E. and Swink, M. (2009), "Towards an operations strategy for product-centric servitization", *International Journal of Operations & Production Management*, Vol. 29 No. 5, pp. 494-519.
- Baines, T. and Shi, V. G. (2015), "A Delphi study to explore the adoption of servitization in UK companies", *Production Planning & Control*, Vol. 26 No. 14-15, pp. 1171-1187.
- Bastl, M., Johnson, M., Lightfoot, H. and Evans, S. (2012), "Buyer-supplier relationships in a servitized environment", *International Journal of Operations & Production Management*, Vol. 32 No. 6, pp. 650-675.
- Beirão, G., Patrício, L. and Fisk Raymond, P. (2017), "Value cocreation in service ecosystems: Investigating health care at the micro, meso, and macro levels", *Journal of Service Management*, Vol. 28 No. 2, pp. 227-249.
- Buckley, P. J. and Strange, R. (2015), "The Governance of the Global Factory: Location and Control of World Economic Activity", *Academy of Management Perspectives*, Vol. 29 No. 2, pp. 237-249.
- Burton, J., Story, V., Zolkiewski, J., Raddats, C., Baines, T. S. and Medway, D. (2016), "Identifying Tensions in the Servitized Value Chain: If servitization is to be successful, servitizing firms must address the tensions the process creates in their value network", *Research-Technology Management*, Vol. 59 No. 5, pp. 38-47.
- Carter, C. R., Meschnig, G. and Kaufmann, L. (2015), "Moving to the next level: Why our discipline needs more multilevel theorization", *Journal of Supply Chain Management*, Vol. 51 No. 4, pp. 94-102.
- Cenamora, J., Sjödin, D. R. and Parida, V. (2017), "Adopting a platform approach in servitization: Leveraging the value of digitalization", *International Journal of Production Economics*, Vol. 192, pp. 54-65.
- Chakkol, M., Karatzas, A., Johnson, M. and Godsell, J. (2018), "Building bridges: boundary spanners in servitized supply chains", *International Journal of Operations & Production Management*, Vol. 38 No. 2, pp. 579-604.
- Chandler, J. D., Danatzis, I., Wernicke, C., Akaka, M. A. and Reynolds, D. (2019), "How does innovation emerge in a service ecosystem?", *Journal of Service Research*, Vol. 22 No. 1, pp. 75-89.
- Connelly, B. L., Ketchen, D. J. and Hult, G. T. M. (2013), "Global Supply Chain Management: Toward a Theoretically Driven Research Agenda", *Global Strategy Journal*, Vol. 3 No. 3, pp. 227-243.
- Ferdows, K. (2018), "Keeping up with growing complexity of managing global operations", *International Journal of Operations & Production Management*, Vol. 38 No. 2, pp. 390-402.
- Ferdows, K., Vereecke, A. and De Meyer, A. (2016), "Delaying the global production network into congruent subnetworks", *Journal of Operations Management*, Vol. 41, pp. 63-74.
- Frank, A. G., Mendes, G. H., Ayala, N. F. and Ghezzi, A. (2019), "Servitization and Industry 4.0 convergence in the digital transformation of product firms: A business model innovation perspective", *Technological Forecasting and Social Change*, Vol. 141, pp. 341-351.

- Gereffi, G. (2014), "Global value chains in a post-Washington Consensus world", *Review of International Political Economy*, Vol. 21 No. 1, pp. 9-37.
- Gereffi, G. and Fernandez-Stark, K. (2011), "Global value chain analysis: a primer", *Center on Globalization, Governance & Competitiveness (CGGC), Duke University, North Carolina, USA*.
- Gereffi, G., Frederick, S. and Bamber, P. (2019), "Diverse paths of upgrading in high-tech manufacturing: Costa Rica in the electronics and medical devices global value chains", *Transnational Corporations*, Vol. 26 No. 1, pp. 1-30.
- Gereffi, G., Humphrey, J. and Sturgeon, T. (2005), "The Governance of Global Value Chains", *Review of International Political Economy*, Vol. 12 No. 1, pp. 78-104.
- Gereffi, G. and Lee, J. (2012), "Why the World Suddenly Cares About Global Supply Chains", *Journal of Supply Chain Management*, Vol. 48 No. 3, pp. 24-32.
- Gibbon, P., Bair, J. and Ponte, S. (2008), "Governing global value chains: an introduction", *Economy and Society*, Vol. 37 No. 3, pp. 315-338.
- Gibson, C. and Warren, A. (2016), "Resource-Sensitive Global Production Networks: Reconfigured Geographies of Timber and Acoustic Guitar Manufacturing", *Economic Geography*, Vol. 92 No. 4, pp. 430-454.
- Golini, R., Caniato, F. and Kalchschmidt, M. (2016), "Linking global value chains and supply chain management: evidence from the electric motors industry", *Production Planning & Control*, Vol. 27 No. 11, pp. 934-951.
- Grubic, T. (2014), "Servitization and remote monitoring technology: A literature review and research agenda", *Journal of Manufacturing Technology Management*.
- Hakanen, T., Helander, N. and Valkokari, K. (2017), "Servitization in global business-to-business distribution: The central activities of manufacturers", *Industrial Marketing Management*, Vol. 63, pp. 167-178.
- Heuser, C. and Mattoo, A. (2017), "Services trade and global value chains", in *Policy Research Working Papers*. The World Bank, Washington, DC, pp. 1-30.
- Huikkola, T., Rabetino, R., Kohtamäki, M. and Gebauer, H. (2020), "Firm boundaries in servitization: Interplay and repositioning practices", *Industrial Marketing Management*, Vol. 90, pp. 90-105.
- Hullova, D., Laczko, P. and Frishammar, J. (2019), "Independent distributors in servitization: An assessment of key internal and ecosystem-related problems", *Journal of Business Research*, Vol. 104, pp. 422-437.
- Humphrey, J. and Schmitz, H. (2001), "Governance in global value chains", *IDS Bulletin*, Vol. 32 No. 3, pp. 19-29.
- Humphrey, J. and Schmitz, H. (2002), "How does insertion in global value chains affect upgrading in industrial clusters?", *Regional Studies*, Vol. 36 No. 9, pp. 1017-1027.
- Johnson, M., Roehrich, J. K., Chakkol, M. and Davies, A. (2021), "Reconciling and Reconceptualising Servitization Research: Drawing on Modularity, Platforms, Ecosystems, Risk and Governance to Develop Mid-Range Theory", *International Journal of Operations & Production Management*.
- Jaakkola, E. and Hakanen, T. (2013), "Value co-creation in solution networks", *Industrial Marketing Management*, Vol. 42 No. 1, pp. 47-58.
- Kano, L. (2018), "Global value chain governance: A relational perspective", *Journal of International Business Studies*, Vol. 49 No. 6, pp. 684-705.
- Kano, L., Tsang, E. W. and Yeung, H. W.-c. (2020), "Global value chains: A review of the multi-disciplinary literature", *Journal of International Business Studies*, Vol. 51 No. 4, pp. 577-622.
- Klein, K. J. and Kozlowski, S. W. (2000), *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions*, Jossey-Bass, San Francisco, CA.
- Klein, K. J., Tosi, H. and Cannella Jr, A. A. (1999), "Multilevel theory building: Benefits, barriers, and new developments", *Academy of Management Review*, Vol. 24 No. 2, pp. 248-253.
- Kohtamäki, M., Einola, S. and Rabetino, R. (2020), "Exploring servitization through the paradox lens: Coping practices in servitization", *International Journal of Production Economics*, pp. 107619.

- Kohtamäki, M., Parida, V., Oghazi, P., Gebauer, H. and Baines, T. (2019), "Digital servitization business models in ecosystems: A theory of the firm", *Journal of Business Research*, Vol. 104, pp. 380-392.
- Koskela-Huotari, K., Edvardsson, B., Jonas, J. M., Sörhammar, D. and Witell, L. (2016), "Innovation in service ecosystems—Breaking, making, and maintaining institutionalized rules of resource integration", *Journal of Business Research*, Vol. 69 No. 8, pp. 2964-2971.
- Kowalkowski, C., Kindström, D. and Carlborg, P. (2016), "Triadic value propositions: When it takes more than two to tango", *Service Science*, Vol. 8 No. 3, pp. 282-299.
- Kowalkowski, C., Kindström, D. and Witell, L. (2011), "Internalisation or externalisation?: Examining organisational arrangements for industrial services", *Managing Service Quality*, Vol. 21 No. 4, pp. 373-391.
- Lanz, R. and Maurer, A. (2015), "Services and global value chains: Some evidence on servicification of manufacturing and services networks", in: WTO staff working paper, Geneva, Switzerland.
- Lenka, S., Parida, V., Sjödin, D. R. and Wincent, J. (2018a), "Exploring the microfoundations of servitization: How individual actions overcome organizational resistance", *Journal of Business Research*, Vol. 88, pp. 328-336.
- Lenka, S., Parida, V., Sjödin, D. R. and Wincent, J. (2018b), "Towards a multi-level servitization framework: Conceptualizing ambivalence in manufacturing firms", *International Journal of Operations & Production Management*, Vol. 38 No. 3, pp. 810-827.
- Lenka, S., Parida, V. and Wincent, J. (2017), "Digitalization capabilities as enablers of value co-creation in servitizing firms", *Psychology & Marketing*, Vol. 34 No. 1, pp. 92-100.
- Lipparini, A., Lorenzoni, G. and Ferriani, S. (2014), "From core to periphery and back: A study on the deliberate shaping of knowledge flows in interfirm dyads and networks", *Strategic Management Journal*, Vol. 35 No. 4, pp. 578-595.
- Macdonald, E. K., Kleinaltenkamp, M. and Wilson, H. N. (2016), "How business customers judge solutions: Solution quality and value in use", *Journal of Marketing*, Vol. 80 No. 3, pp. 96-120.
- McGrath, J. E. (1981), "Dilemmatics: The Study of Research Choices and Dilemmas", *American Behavioral Scientist*, Vol. 25 No. 2, pp. 179-210.
- McWilliam, S. E., Kim, J. K., Mudambi, R. and Nielsen, B. B. (2020), "Global value chain governance: Intersections with international business", *Journal of World Business*, Vol. 55 No. 4, pp. 101067.
- Miroudot, S. and Cadestin, C. (2017), "Services In Global Value Chains: From Inputs To Value-Creating Activities", in: *OECD Trade Policy Papers*. OECD Publishing, Paris, France.
- Mpinganjira, M., Roberts-Lombard, M. and Svensson, G. (2017), "Validating the relationship between trust, commitment, economic and non-economic satisfaction in South African buyer-supplier relationships", *Journal of Business & Industrial Marketing*, Vol. 32 No. 3, pp. 421-431.
- Mudambi, R. (2008), "Location, control and innovation in knowledge-intensive industries", *Journal of Economic Geography*, Vol. 8 No. 5, pp. 699-725.
- Neely, A. (2008), "Exploring the financial consequences of the servitization of manufacturing", *Operations Management Research*, Vol. 1 No. 2, pp. 103-118.
- Niforou, C. (2015), "Labour leverage in global value chains: The role of interdependencies and multi-level dynamics", *Journal of Business Ethics*, Vol. 130 No. 2, pp. 301-311.
- Özatağan, G. (2011), "Dynamics of Value Chain Governance: Increasing Supplier Competence and Changing Power Relations in the Periphery of Automotive Production—Evidence from Bursa, Turkey", *European Planning Studies*, Vol. 19 No. 1, pp. 77-95.
- Palo, T., Åkesson, M. and Löfberg, N. (2019), "Servitization as business model contestation: A practice approach", *Journal of Business Research*, Vol. 104, pp. 486-496.
- Phillips, M. A. and Ritala, P. (2019), "A complex adaptive systems agenda for ecosystem research methodology", *Technological Forecasting and Social Change*, Vol. 148, pp. 119739.
- Ponte, S., Gereffi, G. and Raj-Reichert, G. (2019), *Handbook on Global Value Chains*, Edward Elgar, London, UK.
- Ponte, S. and Sturgeon, T. (2014), "Explaining governance in global value chains: A modular theory-building effort", *Review of International Political Economy*, Vol. 21 No. 1, pp. 195-223.

- Rabetino, R., Harmsen, W., Kohtamäki, M. and Sihvonen, J. (2018), "Structuring servitization-related research", *International Journal of Operations & Production Management*, Vol. 38 No. 2, pp. 350-371.
- Rabetino, R. and Kohtamäki, M. (2018), "To Servitize is to (re) position: Utilizing a Porterian view to understand Servitization and value systems", in Kohtamäki, M., Baines, T., Rabetino, R. and Bigdeli, A. Z. (Eds.), *Practices and tools for Servitization*. Palgrave MacMillan, pp. 325-341.
- Rabetino, R., Kohtamäki, M. and Gebauer, H. (2017), "Strategy map of servitization", *International Journal of Production Economics*, Vol. 192, pp. 144-156.
- Rabetino, R., Kohtamäki, M., Lehtonen, H. and Kostama, H. (2015), "Developing the concept of life-cycle service offering", *Industrial Marketing Management*, Vol. 49, pp. 53-66.
- Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J. and Gebauer, H. (2019), "Servitization: A contemporary thematic review of four major research streams", *Industrial Marketing Management*, Vol. 83, pp. 207-223.
- Raja, J. Z. and Frandsen, T. (2017), "Exploring servitization in China", *International Journal of Operations & Production Management*, Vol. 37 No. 11, pp. 1654-1682.
- Rapaccini, M., Saccani, N., Kowalkowski, C., Paiola, M. and Adrodegari, F. (2020), "Navigating disruptive crises through service-led growth: The impact of COVID-19 on Italian manufacturing firms", *Industrial Marketing Management*, Vol. 88, pp. 225-237.
- Reim, W., Sjödin, D. R. and Parida, V. (2019), "Servitization of global service network actors—A contingency framework for matching challenges and strategies in service transition", *Journal of Business Research*, Vol. 104, pp. 461-471.
- Schmitz, T., Schweiger, B. and Daft, J. (2016), "The emergence of dependence and lock-in effects in buyer-supplier relationships—A buyer perspective", *Industrial Marketing Management*, Vol. 55, pp. 22-34.
- Simsek, Z., Lubatkin, M. H. and Floyd, S. W. (2003), "Inter-firm networks and entrepreneurial behavior: A structural embeddedness perspective", *Journal of Management*, Vol. 29 No. 3, pp. 427-442.
- Sinkovics, N., Sinkovics, R. R., Hoque, S. F. and Alford, M. (2018), "The use of global value chain/global production network related literature in international business research: Investigating the nature and degree of integration", in Cook, G., Johns, J., McDonald, F., Beaverstock, J. and Pandit, N. (Eds.), *The routledge companion to the geography of international business*. Routledge, London, UK.
- Sjödin, D. R., Parida, V. and Kohtamäki, M. (2016), "Capability configurations for advanced service offerings in manufacturing firms: Using fuzzy set qualitative comparative analysis", *Journal of Business Research*, Vol. 69 No. 11, pp. 5330-5335.
- Sjödin, D. R., Parida, V. and Kohtamäki, M. (2019), "Relational governance strategies for advanced service provision: Multiple paths to superior financial performance in servitization", *Journal of Business Research*, Vol. 101, pp. 906-915.
- Sklyar, A., Kowalkowski, C., Tronvoll, B. and Sörhammar, D. (2019), "Organizing for digital servitization: A service ecosystem perspective", *Journal of Business Research*, Vol. 104, pp. 450-460.
- Soontornthum, T., Cui, L., Lu, V. N. and Su, J. (2020), "Enabling SMEs' learning from global value chains: Linking the logic of power and the logic of embeddedness of interfirm relations", *Management International Review*, Vol. 60 No. 4, pp. 543-571.
- Sousa, R. and da Silveira, G. J. (2020), "Advanced services and differentiation advantage: an empirical investigation", *International Journal of Operations & Production Management*.
- Story, V. M., Raddats, C., Burton, J., Zolkiewski, J. and Baines, T. (2017), "Capabilities for advanced services: A multi-actor perspective", *Industrial Marketing Management*, Vol. 60, pp. 54-68.
- Strange, R. and Humphrey, J. (2019), "What lies between market and hierarchy? Insights from internalization theory and global value chain theory", *Journal of International Business Studies*, Vol. 50 No. 8, pp. 1401-1413.
- Timmer, M. P., Erumban, A. A., Los, B., Stehrer, R. and De Vries, G. J. (2014), "Slicing up global value chains", *Journal of economic perspectives*, Vol. 28 No. 2, pp. 99-118.
- Tronvoll, B., Sklyar, A., Sörhammar, D. and Kowalkowski, C. (2020), "Transformational shifts through digital servitization", *Industrial Marketing Management*.

- Vandermerwe, S. and Rada, J. (1988), "Servitization of business: Adding value by adding services", *European Management Journal*, Vol. 6 No. 4, pp. 314-324.
- Vargo, S. L. and Akaka, M. A. (2012), "Value cocreation and service systems (re) formation: A service ecosystems view", *Service Science*, Vol. 4 No. 3, pp. 207-217.
- Vargo, S. L. and Lusch, R. F. (2017), "Service-dominant logic 2025", *International Journal of Research in Marketing*, Vol. 34 No. 1, pp. 46-67.
- Vendrell-Herrero, F., Bustinza, O. F., Parry, G. and Georgantzis, N. (2017), "Servitization, digitization and supply chain interdependency", *Industrial Marketing Management*, Vol. 60, pp. 69-81.
- Wolf, M. (2020), "The dangerous war on supply chains", *Financial Times*.
- Ye, C., Ye, Q., Shi, X. and Sun, Y. (2020), "Technology gap, global value chain and carbon intensity: evidence from global manufacturing industries", *Energy Policy*, Vol. 137, pp. 111094.
- Zhang, W. and Banerji, S. (2017), "Challenges of servitization: A systematic literature review", *Industrial Marketing Management*, Vol. 65, pp. 217-227.



**Figure 1.** Conceptual framework of servitization-driven changes in the structure and governance of GVCs

**Table 1.** Multilevel research on servitization and global value chains

Study	Data and method	Domain	Key findings
(Ponte & Sturgeon, 2014)	Conceptual	GVC	The study offers a modular approach to GVC governance by incorporating micro, meso- and macro-level factors.
(Niforou, 2015)	Conceptual	GVC	Labor's use of power is influenced by different types of interactions and interdependencies along GVCs.
(Lenka <i>et al.</i> , 2018b)	Semi-structured interviews with 35 respondents, multiple case study method	Servitization	Servitizing firms experience organizational ambivalence manifested at multiple levels during servitization because of co-existing product and service orientations.
(Lenka <i>et al.</i> , 2018a)	Multiple case study, six large multinational industrial firms	Servitization	Individuals adopt specific tactics (i.e., evangelizing, bootlegging, leveraging, and collaborating) to overcome organizational resistance to servitization. The study illustrates micro-level actions that drive firm-level servitization.
(Ye <i>et al.</i> , 2020)	Panel data, quantile regression and multilevel mediation analysis	GVC	A country's carbon intensity performance is affected by its technological progress and global frontiers. Changes in the position of GVC convey the impact of the technology gap on carbon intensity
(Kano <i>et al.</i> , 2020)	Systematic literature review	GVC	The study develops a research agenda on issues like microfoundations of GVC governance, GVC mapping, learning, the impact of lead firm ownership and strategy, financialization, and digitization.

**Table 2.** Servitization in the global context

Study	Data and method	Key findings
(Lanz & Maurer, 2015)	Secondary data, descriptive statistics	The paper analyses the role of services in international trade through the lens of GVCs and lays out conceptual and measurement issues related to services networks.
(Cenamor <i>et al.</i> , 2017)	Multiple case studies, 47 interviews	Manufacturing firms leverage value from information modules to facilitate back-end units' orchestrating role and front-end units' builder role as they go through servitization.
(Hakanen <i>et al.</i> , 2017)	Qualitative multiple case study, 27 semi-structured interviews	Servitizing manufacturers develop global service portfolios and locally customized offerings; build global operation models and adjust local service processes; ensure brand coherency and design local customer experiences; and create global value propositions and while enhancing local value cocreation with partners
(Heuser & Mattoo, 2017)	Secondary data, descriptive statistics	Improved access to advanced services facilitates the emergence of global value chains, enhances downstream manufacturing firms' productivity, and shifts the pattern of comparative advantage toward service-intensive sectors.
(Miroudot & Cadestin, 2017)	Secondary inter-country input-output data, descriptive statistics	Manufacturing firms increasingly produce and export services as complements or substitutes to the goods they sell, which is related to strategies aiming at adding more value and creating a long-term relationship with customers.
(Gereffi <i>et al.</i> , 2019)		Servitization serves as one of the paths for paths of upgrading in high-tech manufacturing in GVCs.
(Reim <i>et al.</i> , 2019)	Exploratory case study, 27 interviews	Service network actors face major capability- and market-related challenges that deter their servitization. Four servitization strategies (service extension, service benchmarking, digitalization, customer cocreation) can be implemented to overcome these challenges.